Lubrication and Maintenance

Relubrication

Rolling bearings have to be lubricated if the service life of the grease used is shorter than the expected service life of the bearing. Relubrication should always be undertaken at a time when the lubrication of the bearing is still satisfactory.

The time at which relubrication should be undertaken depends on many factors. These include bearing type and size, speed, operating temperature, grease type, space around the bearing and the bearing environment. The SKF relubrication intervals are defined as the time period, at the end of which 99% of the bearings are still reliably lubricated, and represent L_{01} grease lives. The L_{10} grease lives are approximately twice the L_{01} lives.

The information given in the following does not apply to applications where water and/or solid contaminants can penetrate the bearing arrangement. In such cases it is recommended that the grease is frequently renewed in order to remove contaminants from the bearing.

Relubrication Intervals

The relubrication intervals t_f for normal operating conditions can be read off as a function of bearing speed n and bore diameter d of a specific bearing type from **Figure 15**. The diagram is valid for bearings on horizontal shafts in stationary machines under normal loads. It applies to good quality lithium base greases at a temperature not exceeding +70˚C(+160˚F). To take account of the accelerated ageing of the grease with increasing temperature it is recommended that the intervals obtained from the diagram are halved for every 15˚C(27˚F) increase in bearing temperature above +70˚C(+160˚F), remembering that the maximum operating temperature for the grease should not be exceeded. The intervals may be extended at temperatures lower than +70˚C(+160˚F) but as operating temperatures decrease the grease will bleed oil less readily, and at low temperatures an extension of the intervals by more than two times is not recommended. It is not advisable to use relubrication intervals in excess of 30,000 hours. For bearings on vertical shafts the intervals obtained from the diagram should be halved.

It is also necessary to lubricate more frequently in applications where there is a risk of heavy contamination, e.g.: bearings in papermaking machinery, where housings are washed with water. Large roller bearings having a bore diameter of 300 mm and above, adequate lubrication will be obtained only if the bearing is more frequently relubricated than indicated by the diagram, and the lines are therefore broken. The grease quantity to be supplied can be obtained from the equation below for applications where conditions are otherwise normal, i.e. where external heat is not applied (recommendations for grease quantities for periodic relubrication are given in the following section).

$$G_k = (0.3 \ldots 0.5)\, D\, B \times 10^{-4}$$

where

G_k = grease quantity to be continuously supplied, g/h
D = bearing outside diameter, mm
B = total bearing width (for thrust bearings use total height H),mm

Relubrication procedures

One of the two procedures described below should be used, depending on the relubrication interval t_f obtained:

— If the relubrication interval is shorter than 6 months, then it is recommended that the grease fill in the bearing arrangement be replenished (topped up) at intervals corresponding to 0.5 t_f; the complete grease fill should be replaced after three replenishments.
— When relubrication intervals are longer than 6 months it is recommended as a rough guideline that all used grease be removed from the bearing arrangement and replaced by fresh grease.

Replenishment

By adding small quantities of fresh grease at regular intervals the used grease in the bearing arrangement will only be partially replaced. Suitable quantities to be added can be obtained from

$$G_p\,(g) = .005 \times D\,(mm) \times B\,(mm)$$

$$G_p\,(oz) = \frac{D\,(in) \times B\,(in)}{10}$$

where

G_p = grease quantity to be added when replenishing
D = bearing outside diameter
B = total bearing width (for thrust bearings use total height H)

Grease Supply Systems

Housings without Grease Fittings

For light and medium service, such as line shafts, the original supply of grease will usually last from one to two years or even a longer time at lower ambient temperature. It is, accordingly, advisable to omit grease fittings to discourage over-greasing. The old grease should be removed during overhauls and replaced by new grease, which should be worked into the available space in the bearing by hand. ABMA recommends from ⅓ to ½ of the volume in the housing should be filled with grease for normal applications. An over-supply would only result in churning and breakdown of the lubricant.

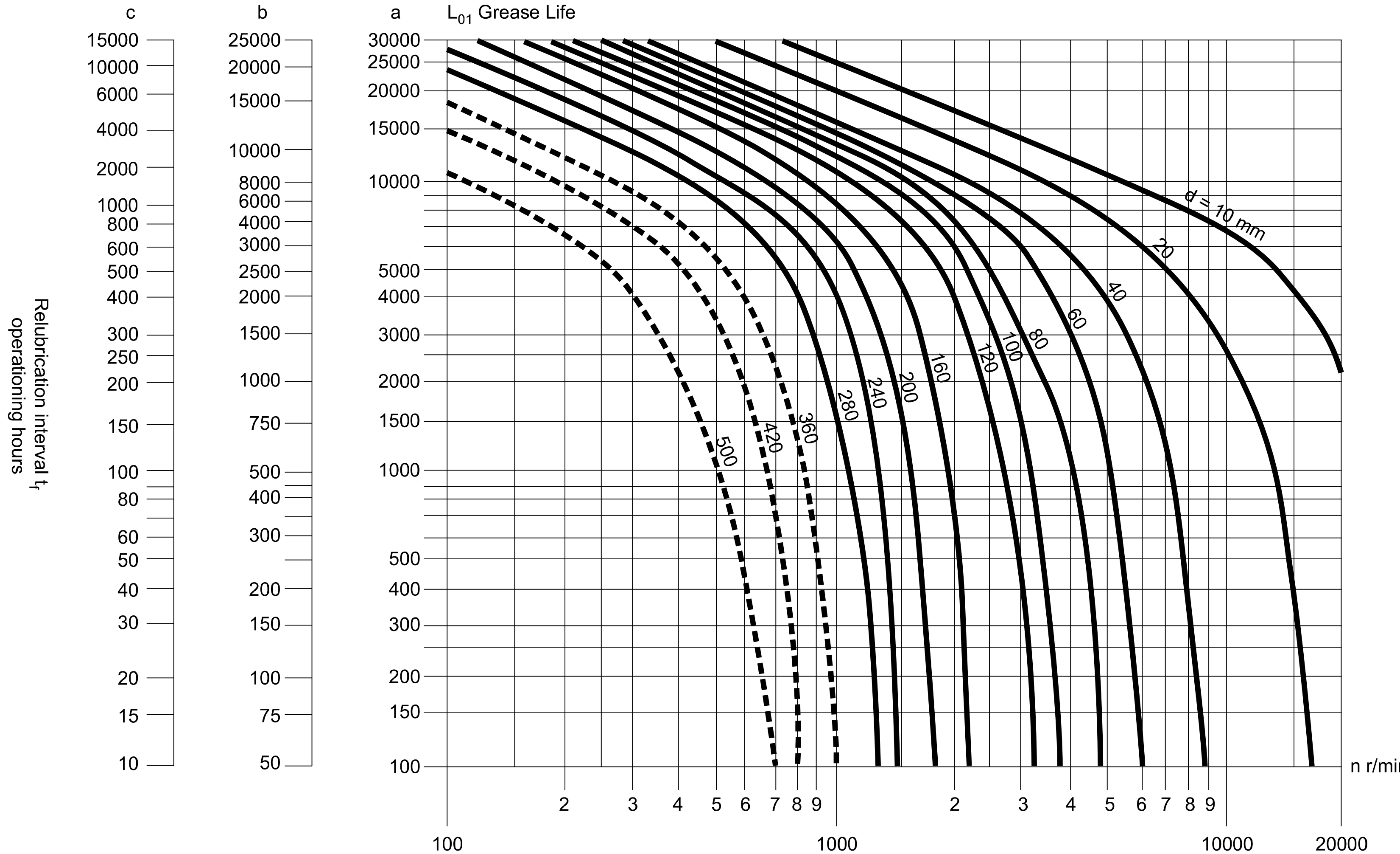
Needless to say, care should be taken to keep the bearing and lubricant clean.

Housings with Grease Fittings

The original filling, and subsequent additions of small amounts of grease after cleaning at major overhauls, should be made as indicated previously.

Adding of lubricant close to the bearing can be effected in several ways. **Figure 16** shows a design which can easily be adapted for this purpose. The lubricant is added using a grease gun at the bottom of the housing, close to the outer ring. The radially placed ribs inside the left-hand end cover tend to deflect the new grease into the bearing without the undesirable effect of first filling the entire space in the

Fig 15



Scale a: radial ball bearings
Scale b: cylindrical roller bearings, needle roller bearings
Scale c: spherical roller bearings, CARB™ toroidal roller bearings, taper roller bearings, thrust ball bearings; cylindrical roller thrust bearings, needle roller thrust bearings, spherical roller thrust bearings ($0.5t_f$); crossed cylindrical roller bearings with cage ($0.3t_f$); full complement cylindrical roller bearings ($0.2t_f$)
d: bearing bore diameter (mm)

Figure 15. See Page 81 for an Example of How to Use This Chart. See pg. 75 (Lubrication and Maintenance) for explanation of L_{01}.

end-cover. These ribs also prevent the grease from being carried around or worked by the rotating shaft, thereby keeping the temperature down and preventing grease leakage. The end-cover on the right-hand side provides ample space to receive the old grease which has passed through the bearing. The cover is split to facilitate removal of the old grease at major overhauls.

Another method which can be used for small and medium size bearings is to force out the old grease with the new. The housing should have a large drain, located on the side opposite the grease fitting, to force all grease to pass through the bearing.

Before adding new grease, make sure that the grease fitting is clean. Clean out any grease which may have caked in the drain hole, so the old grease may be easily expelled. When adding grease, remove the drain plug and force the new grease through the fitting while the shaft is rotating. Continue forcing in new grease until it starts to come out of the drain. The shaft should then be allowed to rotate for about 20 minutes before replacing the drain plug, to give the bearing a chance to expel the excess grease.

Observe cleanliness at all times, whatever method is used, and be sure the new lubricant is clean. Contaminated lubricant will reduce the life of the bearing.

Comparing both methods, the first calls for more skill if the dangers of over-greasing are to be avoided, but has the advantage of being applicable to large bearing sizes, while the latter lends itself readily to small bearings. With large bearings the pressure of the grease gun may not suffice to drive the old grease through the drain to the extent desired. Consequently, the bearings might be left in an over-greased state conducive to hot running.

Grease Chamber Lubrication

The arrangement shown in **Figure 17** employs the use of a double-shielded bearing, which has been prelubricated. One side of the bearing housing is packed full of an appropriate grease by the usual grease gun method. See grease classifications page 72. Addition of lubricant to the original supply takes place by seepage of oil from the grease as well as a small amount of grease being forced though the clearance in the shield. Care should be taken to ensure that the proper type and amount of grease is injected. See replenishment on page 75. This method does not eliminate the need for care in avoiding overgreasing and its consequent overheating and premature failure. Using double-shielded bearings not only helps prevent over-greasing but also protects the bearing from dust and foreign matter at assembly, or whenever the bearing is exposed. Using the double-shielded bearing does not permit the elimination of the usual housing enclosures.

Prelubricated ball bearings without provisions for adding more grease are used in domestic appliances and other machines where the total number of service hours is small. It should be kept in mind that the life of these "greased for life" bearings may be limited to the time the grease will last.

Grease Quantity Regulator

The grease chamber method described above and the frequency of relubrication needed as relative speeds increase both add to the potential for grease buildup in a housing. SKF developed a Grease Quantity Regulator design that prohibits over-greasing regardless of the frequency of lubrication needed. The Regulator is shown adapted to a horizontal application in **Figure 18** and to a vertical application in **Figure 19**. The Regulator consists of a regulating disc, which turns with the shaft and maintains a small radial or tapered gap with a stationary part.

If the grease quantity in the bearing housing does not exceed a limit suitable for that bearing and housing, the grease at both sides of the bearing remains nearly stationary and the temperature remains normal. This is the grease reserve from which oil is supplied to the bearing when bearing temperature begins to increase. If the grease quantity is increased beyond the stable limit, part of the grease is thrown about by the rotating bearing and is thrown against the Regulator and ejected through the drain. The process continues until fresh grease is no longer injected and the operating quantity becomes stable again.

Fig 16

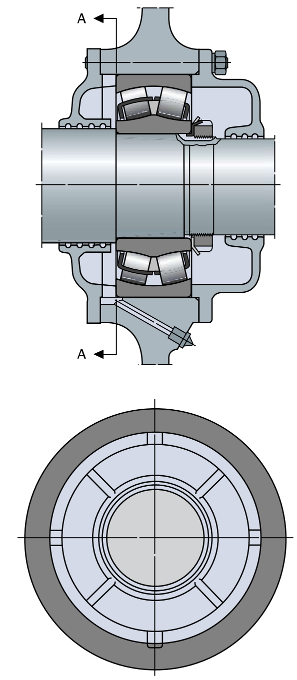


Figure 16. Roller Bearing Arrangement for Large Electric Motor

Fig 17

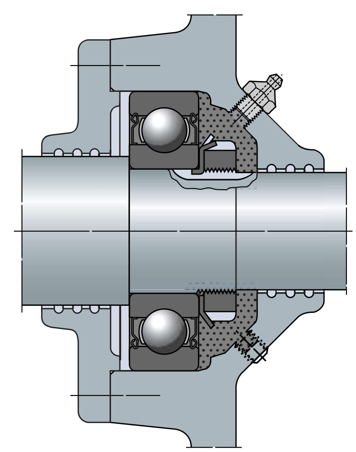


Figure 17. Grease Chamber for Electric Motor

The space between the shield in the bearing and the end-cover is packed with suitable grease.